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Masks, false safety and real dangers, Part 2:
Microbial challenges from masks

Boris Borovoy, Colleen Huber, Maria Crisler

Abstract

Face masks have come into common use in many countries since mid-2020, for all age groups. Some aspect of this may be voluntary, but certainly much of this use is either accompanied by force, threats, subtle coercion, or a continuum of subtle to fierce societal pressures on the individual to conform to mask-wearing. From widespread fear of COVID-19, associated with the virus named SARS-CoV2, mask-wearing is recently assumed by many to be a prudent measure against contagion. In this paper, the second in our series, we continue our examination of the potential hazards of masks, in which we now turn attention to microbial contamination from masks and mask use, changes in oral and nasal microbiota, and potential risks to the lungs and other organ systems from microbial factors. Because widespread masking is a very new society-wide experiment, the impact of this experiment, the obstruction of airways from free breathing and a typical air exchange interplay with oral microbiota is not yet known. Furthermore, the effects of such changes in the lungs and beyond are not yet known. This paper will explore some considerations of these changes, by examining mask effectiveness against transmission, historical evidence of epidemiology from the 1918-1919 pandemic, microbial contamination, respiratory disease and the role of oral bacteria in systemic disease; and infections involving fungi, yeast, and molds. Compiling statistical and scientific evidence from these subjects alone should help equip any individual with adequate information on risks and benefits when choosing whether to wear a mask.

Are masks effective in preventing transmission of infection and are there unintended consequences when wearing them?

Face masks have been adopted by the public of several countries in 2020, with astonishing speed. Conflicting instructions from public health authorities left individual citizens unsure of whether to wear a mask, such that relying on gathered commentary from media and acquaintances in order to make such a decision has become standard. When an individual's preferences are not well formed, merely observing another person makes the option chosen by the other person a social default, that is more likely to be chosen by the observer also.[1]

Concerns regarding use of masks among the public have been voiced by many medical professionals. Over 2,000 Belgian medical professionals, including hundreds of medical doctors, have urged prevention of COVID-19 by means of strengthening natural immunity. Their recommendations, among other measures, include specifically to exercise in fresh air *without a mask.* [2] A number of reasons for this concern have been raised. In this paper, we will examine specifically microbial concerns with regard to mask-wearing.

Masks have been shown through overwhelming clinical evidence to have no effect against transmission of viral pathogens.[3] Penetration of cloth masks by viral particles was almost 97% and of surgical masks was 44%.[4] Even bacteria, approximately ten times the volume of coronaviruses, have been poorly impeded by both cloth masks and disposable surgical masks. Face masks became almost ineffective after two hours of use, and after 150 minutes of use, more bacteria was emitted through the disposable mask than from the same subject unmasked.[5] One must wonder, if new masks worn by healthcare workers, that are soiled by wear during a work shift, transmit more bacteria to patients than from an unmasked healthcare worker, then what is happening to the lungs of the mask-wearer?

Use of personal protective equipment (PPE) has long been debated for healthcare workers regarding their interactions with patients who are carrying highly pathogenic organisms, and this study found about half of even trained healthcare workers in clinical settings make at least one protocol deviation in donning and doffing PPE.[6] Certainly the general public without such training is likely to have a higher rate of similar or more egregious errors in PPE protocol. Masks have been determined to be unnecessary even in surgical settings, and of no benefit in preventing infections.[7] In fact, "The rate of wound infections [while unmasked] was less than half what it was when everyone wore masks." Oral microbial flora dispersed by unmasked healthcare workers standing one meter from the workspace failed to contaminate exposed plates on that surface.[8]

Let us also examine the entire surface area of the masked person when considering that person's potential for transmitting pathogens. Facemasks generally only cover the lower half of the face, which we know from studying burn victims is less than 2% of the entire body surface area.[9] We know that numbers of airborne bacteria expelled from the upper airway are insignificantly small compared with the volume of bacteria shed from the skin.[10] The bacteria shed from the skin of mask wearers was found to create more contamination than from non-mask wearers, presumably due to shifting, wiggling and increased rubbing and exfoliation.[11] [12]

The challenge to the masked person is that the lungs normally expel bacteria with freely exhaled breath, a necessary exhaust system not previously challenged throughout human or even vertebrate history with deliberate obstruction. In this paper we also explore both the effect of masks on microbial transmission as well as the risks and demonstrated problems of re-directed and re-inhaled bacteria and other microbes into the airways.

Are masks effective in preventing transmission of COVID-19 in particular?

COVID-19 is a remarkably low transmissibility disease. This paper shows patterns of transmission to close contacts from those who tested positive for SARS CoV2 in New South Wales high schools and primary schools. From 18 initial positive tests, only 2 out of 863 close contacts tested positive as a secondary case.[13]

In July 2020, the Council of Foreign Relations conducted a survey of 25 countries, with the following question to their citizens:

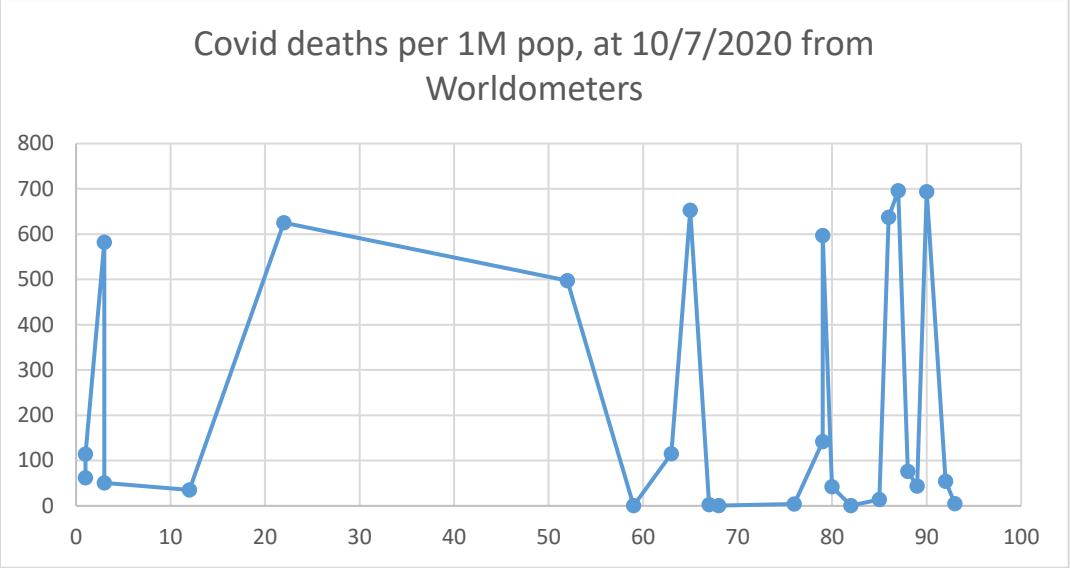
"Have you always worn a face mask outside the home in the last seven days?" The "Yes" responses ranged from 1% in Finland and Denmark, to 93% in Singapore.[14]

We then examined each of the same 25 countries for prevalence of mask use versus Covid-19 deaths per 1 million population. This data was gathered from Worldometers statistics.[15] That data is shown in Table 1, also represented in Graph 1.

Table 1

	% mask use over Jul 6-12, 2020 from CFR survey	Covid deaths per 1M pop, at 10/7/2020 from Worldometers
Singapore	93	5
Philippines	92	54
Brazil	90	694
UAE	89	44
India	88	76
Spain	87	696
Mexico	86	637
Hong Kong	85	14
Thailand	82	0.8
Indonesia	80	42
Italy	79	597
Saudi Arabia	79	142
Malaysia	76	4
Vietnam	68	0.4
China	67	3
United States	65	653
Germany	63	115
Taiwan	59	0.3
France	52	497
United Kingdom	22	625
Australia	12	35
Norway	3	51
Sweden	3	582
Denmark	1	114
Finland	1	62

Graph 1



As we see from the above data, there was no significant correlation with mask use and either increase or reduction of deaths from COVID-19; thus masking could not have caused a significant reduction in deaths. In fact, two of the countries with the highest COVID-19 deaths also had high rates of mask use: Spain at 87% mask use and Brazil at 90% mask use. Again, masking could not have caused a significant reduction in deaths.

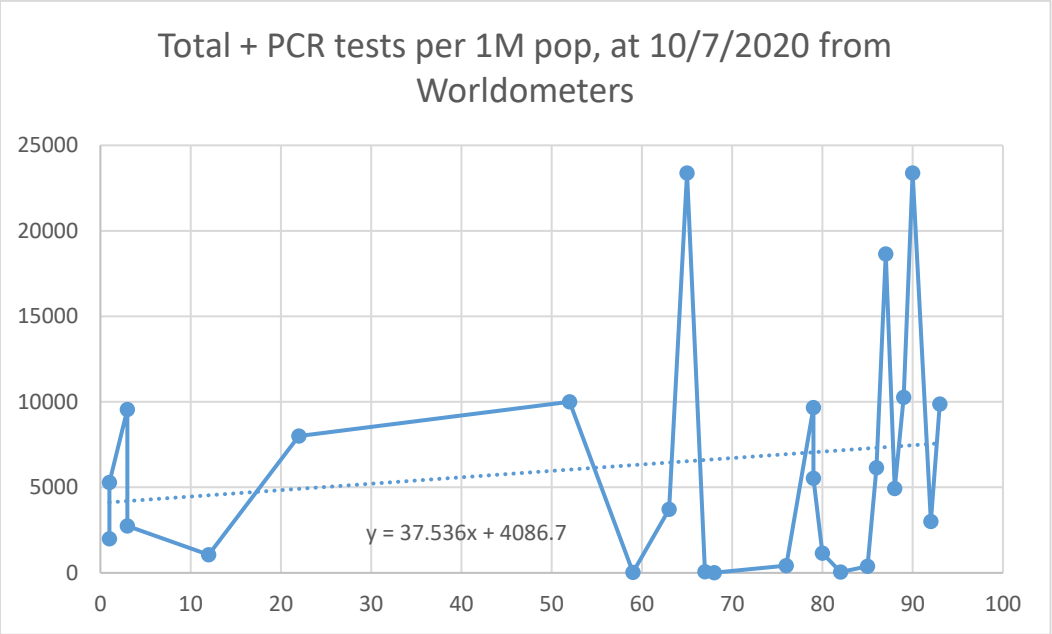
Another table presented from Worldometers data also demonstrates the rate of positive COVID-19 PCR tests per one million population in the same 25 countries surveyed. This data is reported in Table 2 and Graph 2.

Table 2

	% mask use over Jul 6-12, 2020 from CFR survey	Total + PCR tests per 1M pop, at 10/7/2020 from Worldometers
Singapore	93	9866
Philippines	92	2998
Brazil	90	23378
UAE	89	10264
India	88	4938
Spain	87	18654
Mexico	86	6146
Hong Kong	85	385
Thailand	82	52
Indonesia	80	1151
Italy	79	5525
Saudi Arabia	79	9661

Malaysia	76	431
Vietnam	68	11
China	67	59
United States	65	23385
Germany	63	3708
Taiwan	59	22
France	52	10006
United Kingdom	22	8006
Australia	12	1063
Norway	3	2742
Sweden	3	9557
Denmark	1	5297
Finland	1	1993

Graph 2



Contrary to data in table 1, we do see a significant trend in table 2. Curve-fitting a trend line, we see a positive slope for this line of 37.536. That is, for every increased percentage point of mask use in a country, there were an average of 37.536 additional positive PCR tests per one million population. This shows that masking has not accomplished the advertised function of reducing the number of positive PCR tests, but rather seems to be correlated with an increased number of positive PCR tests for COVID-19.

The historical role of bacteria in a viral pandemic

It is not at all an anomaly for fatal pneumonia to follow coronavirus infections.[16] Indeed, historical data support a correlation between pandemic and bacterial pneumonia. It is thought that the majority of deaths in the 1918-1919 pandemic "likely resulted directly from secondary bacterial pneumonia caused by common upper respiratory-tract bacteria." [17] Histopathology of lung tissue sections from that time reveal, "in virtually all cases, compelling histologic evidence of severe acute bacterial pneumonia, either as the predominant pathology or in conjunction [with influenza]." Histological evidence revealed presence of bacterial pneumonia, including bronchopneumonia. Lobar consolidation characteristic of pneumococcal pneumonia, as well as pathognomonic characteristics of streptococcal and staphylococcal pneumoniae were found. In fact, there were no negative lung culture results in any of the specimens. "Bacteria were commonly observed in the sections, often in massive numbers." In fact the bacterial damage was extensive. Vasculitis, capillary thrombosis and necrosis surrounding areas of bronchiolar damage were found. And "without this secondary bacterial pneumonia, experts generally believed that most patients would have recovered."[18]

Interestingly the above-cited paper that found a majority of 1918-1919 pandemic deaths to be from bacterial pneumonia was co-authored by Anthony Fauci, MD who has been tasked with advising the US on proper response to the 2020 COVID-19 pandemic, yet he has not publicly discussed this precedented risk of bacterial pneumonia in 2020, even having performed extensive research himself. It is also known that the 1918-1919 pandemic was the last time that human societies experimented with widespread long-term masking. As now, healthy people were made to wear masks, and it is thought by some that there would have been no pandemic in 1918 without masking. Are we repeating known mistakes from our history and what are the consequences?

The cities of Stockton CA and Boston MA were compared as follows during that pandemic.[19]

"**Masks:** The wearing of proper masks in a proper manner should be made compulsory in hospitals and for all who are directly exposed to infection. It should be made compulsory for barbers, dentists, etc. The evidence before the committee as to beneficial results consequent upon the enforced wearing of masks by the entire population at all times was contradictory, and it has not encouraged the committee to suggest the general adoption of the practice. Persons who desire to wear masks, however, in their own interests, should be instructed as to how to make and wear proper masks, and encouraged to do so.

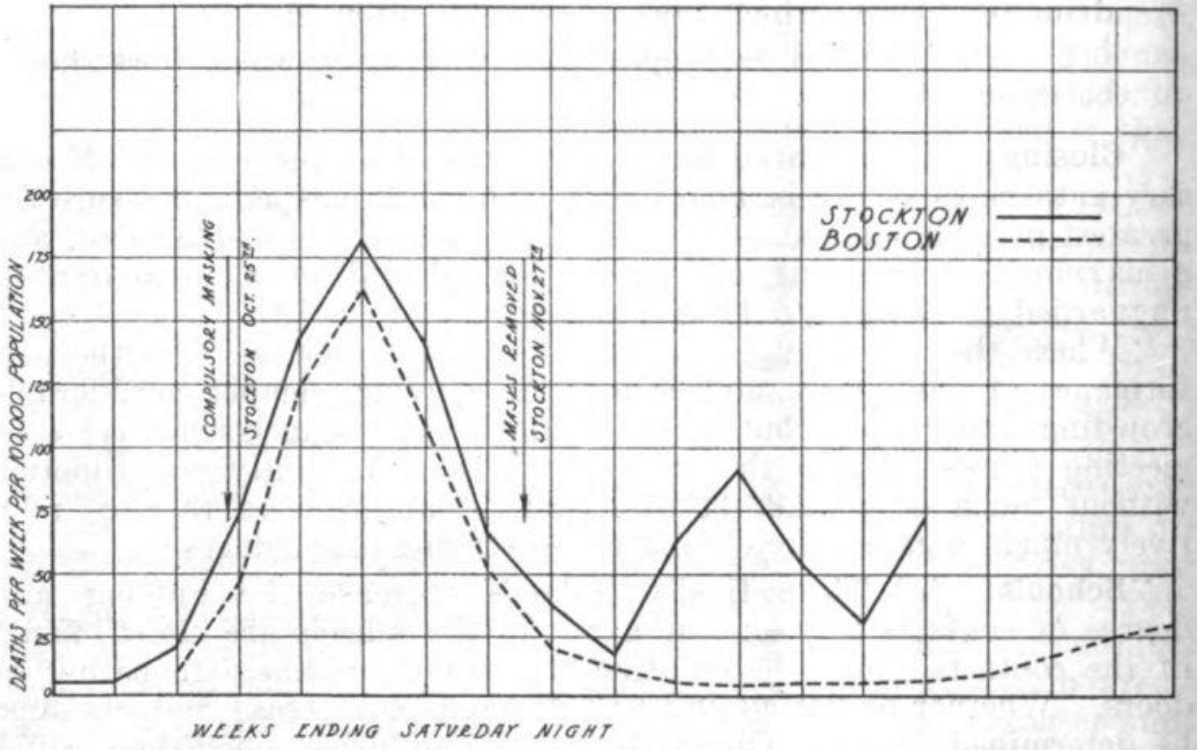


FIG. 17. Stockton, California, and Boston, Massachusetts. Comparative death rates per 100,000 population, by weeks. The use of masks was made compulsory in Stockton, but not in Boston.

One historian writes, "The quarantine, isolation and mask-wearing failed to diminish the spread of the influenza. Instead the practices likely increased fatality and had disastrous economic consequences. The medical policy of 1918 was contrary to the medical science of 1918, and the destructive practices of quarantine, isolation and mask-wearing were largely abandoned."[20]

The harm extended to the next generation. Subsequent health outcomes included increased prevalence of heart disease in infants born in 1919. [21]

Microbial contamination of and from masks

Bacteria are on average ten times the size of viruses, particularly coronaviruses, and have less penetration through masks.[22] Therefore, at least part of the re-circulated flow of bacteria in aerosolized and droplet exhalation does not escape the vicinity of the oral and nasal environment. Bacteria and other microbes are not only retained in this space, but masks themselves are warm, moist repositories of these microbes.

Laboratory testing of used masks from 20 train commuters revealed that 11 of the 20 masks tested contained over 100,000 bacterial colonies. Molds and yeasts were also found. Three of the masks contained more than one million bacterial colonies.[23] Because such particles have been cultured from masks, they are expected to remain fully available to the airways while a mask is worn.

The outside surfaces of surgical masks were found to have high levels of the following microbes, even in hospitals, more concentrated on the outside of masks than in the environment.[24] Staphylococcus species (57%) and Pseudomonas spp (38%) were predominant among bacteria, and Penicillium spp (39%) and Aspergillus spp. (31%) were the predominant fungi. These correlated with the same bacteria and fungi found in samples of the ambient air where the masks were worn.[25]

Evidence is still not abundant of injury from mask-carried microbes due to the experimental and newly adopted practice of widespread masking. Even in Asia, where public use of masks had been more common than in the west, masks were generally only worn by those who had to travel in public while suffering a respiratory illness or those suffering from seasonal pollen allergies. Without regard to the 1918-1919 epidemic, widespread masking is new again in 2020.

We further demonstrate absence of evidence is not evidence of absence. Decades of clinical evidence have attributed a variety of moderate and severe pathologies to microbes that originate in the mouth and nose, as we discuss in this paper.

The mechanism of pathology originating from masks is likely as follows: Microbe-carrying droplets, trapped in masks, stay damp while the mask is worn, whereas without a mask, exhaled droplets and aerosol are known to dry quickly. In the continually damp environment of the mask, bacteria start to proliferate, are re-inhaled and then transferred throughout the body, as discussed below.

Bacteria are exhaled through masks at an increasing rate over the time of use.[26] Outward penetration of masks by bacteria is made worse by the plosive force of coughing, sneezing and talking loudly. Scatter mechanics from the mesh of the mask and resulting chaotic collisions of aerosolized droplets in turn produce a wider contaminated airspace outside the masked mouth than outside the unmasked mouth, in the same way that a screen placed under a faucet disperses the water falling through it.

Cloth mask wearers had significantly higher influenza-like illness when compared to unmasked.[27] This meta-analysis found no benefit of masks against transmission of laboratory-confirmed influenza, in analysis of 14 randomized controlled trials.[28]

James Meehan MD reports seeing patients clinically that have facial rashes, fungal infections, bacterial infections. "Reports coming from my colleagues from all over the world, are suggesting that the bacterial pneumonias are on the rise." Dr. Meehan reports that this is "because untrained members of the public are wearing medical masks repeatedly . . . in a non-sterile fashion."[29]

Recently, a group A strep throat outbreak of unusual size in Michigan public schools where masks are mandatory was reported during the week before this writing.[30] A number of factors may be involved in this outbreak. Not only are students being forced to wear masks, but also schools were closed during lockdown long enough to possibly allow buildup of microbes in their ventilation systems. The problem may be compounded by masks damaging immunity, not being properly washed, poor training of PPE use, or even trapping Streptococcus while forcibly trying to inhale and exhale. After all, deeper inhalation, as we know happens with mask wearing, could have produced a concerning health hazard.

What may be an even more intractable health hazard is the vast range of possibilities where normally colonized strains of oral and nasal bacteria interact with newer virulent strains in the favorable incubating environment of face masks. The possibility of superstrains and their consequences in the population will likely eclipse the effects and the incidence of the relatively mild COVID-19 virus (estimated IFR 0.015[31]),, as we have seen from the autopsies discussed above of the 2018-2019 pandemic victims.

Respiratory diseases from oral bacteria

CPAP has been used for decades, but universal masking is very new. We know that wearing the CPAP mask has led to life-threatening Legionella pneumonia as well as Streptococcus infections.[32] This disproves the hypothesis that microbial growth on masks is always benign.

Aspiration pneumonia is a consequence of oral bacteria aspirated into the lungs. The teeth and gums are reservoirs for respiratory pathogens.[33] [34] Oral dysbiosis is a disordered ecosystem of commensal as well as pathogenic bacteria in the mouth. Dental caries and periodontal disease are common results of such dysbiosis. One dental practice estimates that 50% of their patients are suffering from mask-induced dental problems, including decaying teeth, receding gum lines and "seriously sour breath."[35] The dentists theorize that these new oral infections are mostly caused by the tendency for people to mouth-breathe while wearing a mask, which is not consistent with the evolution of the form and functionality of the airways of humans or any other species.

The oral flora is known to comprise over 700 bacterial species, inhabiting the epithelial debris, nutrients and oral secretions in the oral environment. Streptococci, lactobacilli and staphylococci are among the most common of these bacteria. Together, they comprise the biofilm that coats the surfaces of the oral cavity. Clearly, the bacteria benefit from the host, but the host may also benefit from the bacteria and contribute to our immunity by the production of secretory antibodies against new pathogens. The commensal relationship of oral flora with the host is generally benign and stable, unless the same bacteria achieve access to deeper tissues and blood. A number of serious and life-threatening diseases result when this happens.

Bacteria that live in the mouth and upper respiratory tract may be aspirated and cause infection in the lungs. We know that mask-wearers have greater inspiratory flow than non-mask wearers.[36] This is presumably due to the hypoxic condition of mask obstruction to the airways. As a result, microbes may be more likely to be aspirated while wearing a mask than not wearing one.

Damage to the airways results from bacterial colonization. When bacteria localize to the site(s) of infections in the respiratory tract and induce local airway inflammation, epithelial damage results. Such damage only requires bacterial colonization of the airways to begin this process, and to progress to bacterial-induced chronic airway inflammation.[37] This process begins with resident bacteria in oral secretions being aspirated and then adhering to the respiratory epithelium. These stimulate cytokine production and inflammation.[38]

In fact, the very same periodontopathic bacteria are involved in the pathogenesis of respiratory diseases. These may be some of the diseases implicated in COVID-19.[39] Conversely, oral hygiene measures have correlated with improved outcomes in pneumonia patients[40] and those generally with respiratory tract infections, [41] as well as other lung diseases, such as COPD.[42]

Infections don't only take hold from one species of pathogenic microbes. A pathogenic synergy can result in the flourishing of a particular pathogen. This was found to be the case with Aggregatibacter actinomycetemcomitans together with Streptococcus gordonii, both of which are commonly found in the mouth and in its abscesses.[43] With the concentration and culturing of microbes on the surface of a mask, is this pathogenic synergy made more likely while wearing a mask?

Systemic diseases from oral and nasal bacteria

When oral bacteria gain access to blood and deep tissues, they may cause pneumonia, abscesses in lung tissue, subacute bacterial endocarditis, sepsis and meningitis. [44] It is important to consider that endocarditis can be a lifelong infection. Strep pyogenes bacteria has been observed for decades to cause irreversible fibrosis in heart tissue long after the bacteria were no longer found.[45] This bacteria is known by many as "flesh eating strep". Former Streptococcus infections that had seemingly resolved a long time ago may still be positive in an

Antistreptolysin O test. For years afterward, flares of toxins can be released in the body at times of stress or secondary infection and cause debilitating symptoms.

Additionally Type 2 diabetes, hypertension, and cardiovascular diseases have been the result of oral bacteria gaining access to deeper tissue.[46] These are among the diseases reported as co-morbidities associated with an increased risk of death attributed to COVID-19. COPD[47] and in this enormous study, cancer can also result simply from the access of oral bacteria to deeper tissue.[48]

Immune-mediated inflammatory disorders, commonly known as auto-immune diseases are correlated with oral dysbiosis. We know that transient bacteria from an oral infection or a dental procedure can gain access to the blood for systemic circulation. Those bacteria can produce toxins that trigger tissue damage or other pathological changes. These molecules may react with antibodies that produce large complexes, which are associated with acute and chronic inflammatory changes.[49] [50] Such auto-immune diseases as rheumatoid arthritis, systemic lupus erythematosus and Sjogren's syndrome all have features of oral dysbiosis.[51]

Autoimmune encephalitis occurs when microbes access brain tissue, triggering neurological or psychiatric symptoms. This complex of diseases include basal ganglia encephalitis, and can be triggered by bacterial, viral and fungal infections. Some of the most pernicious of this group of diseases is pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS). Group A Streptococcus (GAS) is a very common illness, and the most common bacterial infectious agent of sore throat, "strep throat," and is one of the microbial agents involved in PANDAS. GAS causes one million to 2.6 million cases of strep throat each year.[52]

Repeated infections in the nasal cavity can lead to Th1 and Th17 lymphocytes in the surrounding nasal tissue. These are pro-inflammatory and target host cells in a misdirected immune response. The Th17 cells travel into the brain along the olfactory nerves, through the cribriform plate from the nose or throat or palate and into the brain. These in turn stimulate cytokines, which then stimulate microglia. The endothelial cells in the blood brain barrier are broken down by damaging both the tight junctions in the endothelium, and by increasing transcytosis of auto-antibodies that are circulating in the blood to access the brain. This mechanism has been shown to lead to the abrupt onset of neurological and psychiatric symptoms associated with the PANDAS diagnosis.[53]

Our nasal passages are colonized by Staphylococcus bacteria, among other organisms. Under typical circumstances, these pose no threat to the individual; however, Mayo Clinic has warned, (although this statement has now been erased from their site):

> ***"A growing number of otherwise healthy people are developing life-threatening staph infections because of mask wearing."[54]***

One of the risks of mask wearing is that masks maintain bacteria in greater numbers and for a longer period of time. This increases the risk of those bacteria entering the respiratory system and/or blood stream through micro wounds.

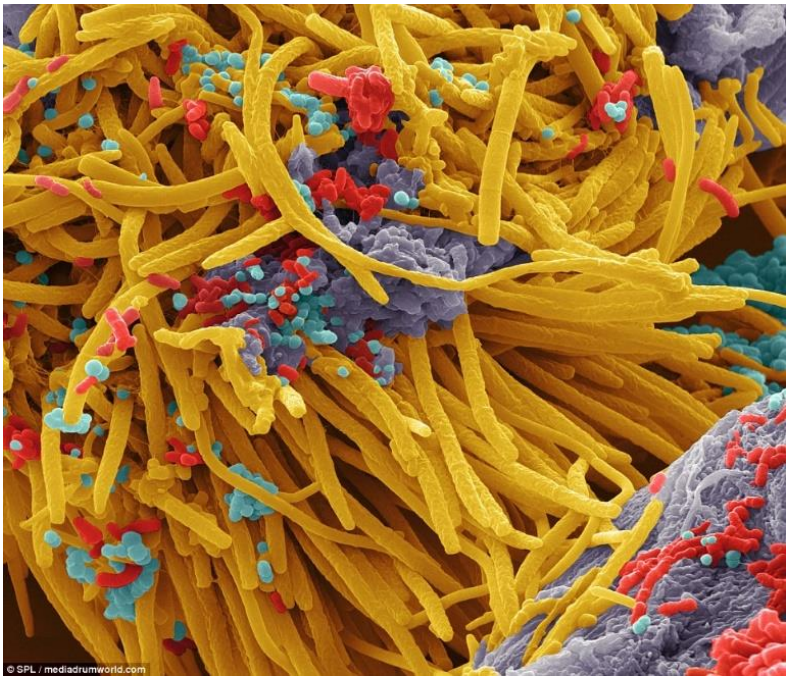
The following are some of the diseases and conditions that may result. Bacteremia is a condition in which bacteria can travel to internal organs, muscle, bone and prosthetic devices. Toxic shock syndrome is a condition in which some strains of Staphylococcus produce toxins that create high fever, nausea, vomiting and other symptoms. Septic arthritis occurs when staph bacteria infect the joints, which may result in pain, swelling and fever.

The risk of pericarditis caused by staphylococcus has been known since at least 1945.[55] This life-threatening disease has been treated with prolonged antibiotic therapy and aggressive drainage of the pericardium,[56] and, in severe cases, surgical resection of the pericardium.[57] Purulent pericarditis is the most serious consequence of bacterial pericarditis, and is always fatal if untreated. Even in treated patients the mortality rate is 40%.[58]

Streptococcus is a commensal organism of the oral mucosa, and is the most common infective agent causing endocarditis.[59] It is not so unusual for oral Streptococci to gain access to the bloodstream, and oral Streptococci comprise more than half of colonies cultured from blood following dental procedures. "Oral streptococcal bacteremia is frequently associated with the development of septic shock and death."[60]

Cardiovascular and rheumatological outcomes from mask-wearing are unlikely to be realized in the United States for at least several months due to the recentness of mask wearing; although we can learn from the history of prevalence of cardiovascular disease many years after the 1918-1919 forced masking pandemic described previously. These are enormous concerns on the horizon for future public health considerations.

Oral bacteria, with added color, under scanning electron microscope.
https://www.dailymail.co.uk/sciencetech/article-3549713



Infections involving fungi, yeast and molds

Aspergillosis is an infection of the lungs by the spores of the Aspergillus fumigatus fungus. These spores are ubiquitous in the environment, indoors and outdoors, and are usually harmless. There are many environmental sources of Aspergillus. Decaying leaves and compost in the outdoors around trees and plants, as well as indoors in bathrooms are common locations of Aspergillus. These spores may be inhaled by those with weakened immune systems and can be a cause or a result of bronchiectasis.[61] This is a chronic airway infection syndrome, and as indicated above, a risk from inhaled fibers. Fungal fibers may be inhaled and accumulate as fungal balls known as aspergillomas. At its worst, Aspergillosis can proceed to systemic infection, with consequences to the brain, heart and kidneys. Invasive aspergillosis spreads rapidly and may be fatal.

Aspergillus as well as candida also produce gliotoxins, which are immunosuppressive toxins that in turn enable proliferation of candida. The mechanism of immunosuppression appears to be by alteration of the structure and function of PMN neutrophils.[62]

It is possible that a warm moist environment, such as a mask worn outdoors or in bathrooms may pick up and harbor fungal spores as well as particulate and/or loose fibers. This is normally not a concern for a healthy person or an unmasked person. When mold spores are inhaled by a healthy person, immune system cells surround and destroy them. Masks provide an alternative environment whereby mold and fungi are held and trapped beyond typical airborne levels. When maintained over the airways, this can create a risk for the mask-wearer. Simply, if the masks retain fungal spores, these may be dislodged with inhalation.

Conclusion

Masks have been shown consistently over time and throughout the world to have no significant preventative impact against any known pathogenic microbes. Specifically, regarding COVID-19, we have shown in this paper that mask use is not correlated with lower death rates nor with lower positive PCR tests.

Masks have also been demonstrated historically to contribute to increased infections within the respiratory tract. We have examined the common occurrence of oral and nasal pathogens accessing deeper tissues and blood, and potential consequences of such events. We have demonstrated from the clinical and historical data cited herein, we conclude the use of face masks will contribute to far more morbidity and mortality than has occurred due to COVID-19.

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